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विशिष्टि
(चौथा पुनरीक्षण)

Indian Standard
INDUSTRIAL TEXTILES — PRESSED
WOOL FELTS — SPECIFICATION
(*Fourth Revision*)

ICS 59.080.20

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by Geotextiles and Industrial Fabrics Sectional Committee had been approved by Textile Division Council.

This standard was first published in 1961 and then revised in 1969, 1979 and 1988. The standard has been revised again to effect the following:

- a) Tolerance on thickness of precision felt has been modified.
- b) Requirement in respect of pH value of aqueous extract has been modified.
- c) Chemical requirements for proofed and unproofed felts have been specified separately.
- d) Provision has been made for use of variety of proofing agents.
- e) Grades of wool tops for various grades of felts have been suggested.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 :1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

INDUSTRIAL TEXTILES — PRESSED WOOL FELTS — SPECIFICATION

(*Fourth Revision*)

1 SCOPE

1.1 This standard prescribes the requirements for two types of pressed wool felts, namely general purpose felts and precision felts each having eight grades on the basis of density.

1.2 This standard does not specify the general appearance, feel, shade, etc. of the felt (*see also 7*).

2 REFERENCES

The Indian Standards given in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given in Annex A.

3 TERMINOLOGY

3.1 Wool Felt — A textile material composed of wool fibres, physically interlocked by inherent felting property of wool and produced by a suitable combination of mechanical work, chemical action, moisture and heat but without weaving, knitting, stitching, thermal bonding or adhesives.

3.2 General Purpose Wool Felts — Wool felts used for packing, padding, cushioning, insulation and similar purposes.

3.3 Precision Wool Felts — Wool felts used in engineering applications where closer tolerances are required.

4 TYPES AND GRADES

The wool felts of each type, namely general purpose felt and precision felt are classified into eight grades on the basis of density, namely extra hard, hard, extra firm, firm, medium firm, medium, soft and extra soft.

5 MANUFACTURE

5.1 The recommended grades of wool for the manufacture of different types of felts are given below:

<i>Type</i>	<i>Grade of Wool (see Note)</i>
Extra hard	64 ^s /70 ^s
Hard	48 ^s
Extra firm, firm, medium firm and medium	48 ^s
Soft (for use in orthopaedics)	64 ^s noils
Soft (for use in packing)	48 ^s

NOTE — A reference may be made to IS 5910 for the specification of different grades of wool.

5.1.1 The hardened felt is obtained by pressing a number of layers of carded web to ensure the requisite thickness and making it somewhat hard under the influence of moisture, heat and pressure. The milled finish is obtained by further subjecting the hardened felt to milling to achieve the requisite thickness and compactness of texture.

5.2 The edges of the felt shall be uniform. The tenter-hook holes, if any, shall not be beyond 2.5 cm from the edges. The felt shall have reasonably smooth surface and shall be reasonably free from thick and thin places, pits, corrugations, stains, burrs, etc.

5.3 Proofing

If required by the buyer, the felt shall be proofed. The impregnation with proofing agent shall be carried out in such a manner that the cross-section of the felt is uniformly treated. The proofing agents employed (*see also* Notes 1 to 3) for the type of proofness required shall be as under:

<i>Requirement</i>	<i>Proofing Agent</i>
Insect and moth resistance (for use of felt under tropical condition)	2, 4 Dinitro-alphanaphthol (DNAN) or Dinitro-ortho-cresol (DNOC)
Rot resistance	Copper naphthenate or Cuprammonium emulsion or Para-nitrophenol
Insect, moth and rot	Copper naphthenate or Cuprammonium emulsion followed by DNAN or DNOC

NOTES

- 1 Proofing agents other than those prescribed above may be used subject to the agreement between the buyer and the seller. Proofing agents shall, however, be of such a nature and composition that its required amount can be estimated by a chemical test.
- 2 The use of DNAN and para-nitrophenol imparts yellow colour to the felt; hence these may be used only in such cases where yellowing of felt is not objected to.
- 3 The felt proofed with cuprammonium emulsion or copper

naphthenate shall not be used in contact with explosives containing ammonium nitrate unless the felt is thoroughly waxed.

6 REQUIREMENTS

6.1 Physical Requirements

The general purpose felts and precision felts shall conform to the physical requirements prescribed in Tables 1 and 2 respectively.

Table 1 Physical Requirements for General Purpose Felts
(Clause 6.1)

Type	Thickness	Density	Tensile Strength (see Note 2)	Splitting Resistance (see Note 2)	Length	Width	Finish
(1)	mm (2)	g/cm ² (3)	kPa (4)	Min, N/cm (5)	m (6)	cm (7)	(8)
Extra hard	As agreed (see Note 1)	0.60	4 100	75	As	As	Milled
Hard		0.46	3 400	65	declared	declared	Milled
Extra firm		0.40	2 900	55	or	or	Milled
Firm		0.34	2 400	40	agreed	agreed	Milled
Medium firm		0.27	1 500	26	(see Note 3)	± 2 percent	Milled
Medium		0.23	1 400	22	(see Note 2)	Note 3)	Milled
Soft		0.18	900				Hardened
Extra soft		0.15	(see Note 2)	(see Note 2)		Hardened	
Method of Test	B-2	B-3	B-4	B-5	← IS 1954 →		

NOTES

- 1 The common thicknesses of felts are 1.5, 3, 6, 10, 13, 16, 19, 22 and 25 mm.
- 2 The requirements of tensile strength and splitting resistance are recommendatory and shall be applicable, if specifically agreed to between the buyer and the seller. However, the splitting resistance shall not be applicable in case of felts having thickness of 6 mm and below and also in case of soft and extra soft felts. Tensile strength shall not be applicable in case of extra soft felts.
- 3 No negative tolerance shall be permitted on length of felt.

Table 2 Physical Requirements for Precision Felts
(Clause 6.1)

Type	Thickness	Density	Tensile Strength (see Note 2)	Splitting Resistance	Oil Retention Percent	Length	Width
(1)	mm (2)	g/cm ² (3)	kPa (4)	Min, N/cm (5)	(6)	m (7)	cm (8)
Extra hard	As agreed (see Note 1)	0.60	5 500	100	80	As	As
Hard		0.46	4 500	87	90	declared	agreed
Extra firm		0.40	3 800	70	100	or	± 2 percent
Firm		0.34	3 100	50	120	agreed	
Medium firm		0.27	2 000	35	140	(see Note 3)	
Medium		0.23	1 800	30	150		
Soft		0.18	1 200	25	160		
Extra soft		0.15	—	—	—	—	
Method of Test	B-2	B-3	B-4	B-5		← IS 1954 →	

NOTES

- 1 The common thicknesses of felts are 1.5, 3, 6, 10, 13, 16, 19, 22, 25 and 50 mm.
- 2 The splitting resistance shall not be applicable in case of felts having thickness of 6 mm and below.
- 3 No negative tolerance shall be permitted on length of felt.

6.1.1 The tolerance on thickness and density of general purpose felts shall be as follows:

<i>Felt Thickness</i>	<i>Tolerance on Nominal Thickness and Density</i>	<i>Tolerance on Individual Value of Thickness</i>
4.0 mm and below	±20 percent	±25 percent (<i>see Note</i>)
4.1 to 10 mm	±15 percent	±20 percent (<i>see Note</i>)
Above 10 mm	±10 percent	±15 percent

NOTE — The minimum tolerance of ± 0.5 mm shall be permitted on the individual value of thickness.

6.1.2 The tolerance on thickness and density of precision felt shall be as follows :

<i>Felt Thickness</i>	<i>Tolerance on Thickness Value of Thickness</i>	<i>Tolerance on Individual Nominal Density</i>	<i>Tolerance on</i>
Up to 10 mm	±7.5 percent	±12.5 percent (<i>see Note</i>)	±10 percent
Above 10 mm	±7.5 percent	±10 percent	±7.5 percent

NOTE — The minimum tolerance of ± 0.5 mm shall be permitted on the individual value of thickness.

6.2 Chemical Requirements

If agreed to between the buyer and the seller, the felts shall also conform to any or all the requirements specified in Table 3.

6.3 Colour Fastness

The dyed felts shall also conform to minimum colour fastness requirements as specified in Table 4 .

6.4 Wool Content ,

The wool content of the felts shall not be less than 95

percent when determined by the method given in IS 8476.

7 SEALED SAMPLE

7.1 If in order to illustrate or specify the general appearance, feel, shade and finish of felt, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

7.1.1 The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

Table 3 Chemical Requirements for Felts
(Clauses 6.2 and 6.2.1)

Sl No.	Characteristics	Requirement		Method of Test, Ref to IS No.
		Proofed	Unproofed	
i)	pH vlaue of aqueous extract	6.5 to 7.5	6.5 to 7.5	IS 1390 (Cold method)
ii)	Chloride content, percent, <i>Max</i>	0.05	0.05	IS 4202
iii)	Sulphate content, percent, <i>Max</i>	0.25	0.20	IS 4203
iv)	Benzene methyl alcohol soluble matter, percent, <i>Max</i>	5.0	3.5	IS 5152
v)	Water soluble matter, percent, <i>Max</i> (<i>see Note</i>)	3.0	2.0	IS 3456
vi)	Ash content, percent, <i>Max</i>	4.0	3.5	IS 199
vii)	Non-wool content, percent, <i>Max</i>	5.0	5.0	B-7
viii)	Proofing agent, percent, <i>Min</i>			
	a) DNAN or DNOC	0.30	—	IS 3522 (Parts 1, 2 and 3)
	b) Copper content of copper naphthelate or cuprammonium emulsion	0.65	—	do
	c) Para-nitrophenol	0.25	—	do

NOTE — The water soluble matter shall be determined after removal of matter soluble in benzene methyl alcohol.

Table 4 Colour Fastness Requirements for Decorative Felts
(Clause 6.3)

Sl No.	Colour Fastness	Minimum Rating	Method of Test, Ref to IS No.
i)	Light (<i>see</i> Note)	5 or better	IS 2454 or IS 686 IS 766
ii)	Rubbing		
	a) Wet	3 or better	
	b) Dry	4 or better	
iii)	Water		IS 767
	a) Change in colour	4 or better	
	b) Staining on adjacent fabric	4 or better	

NOTE — In case of dispute, the method given in IS 686 shall be followed.

8 MARKING

8.1 The felts shall be marked with the following information :

- a) Name of the material, namely, the type of wool felt, for example ,
 - 1) General purpose wool felt, extra hard, proofed; or
 - 2) Precision wool felt, hard, unproofed,
- b) Thickness in mm;
- c) Length in m and width in cm;
- d) Manufacturer's name, trade-mark or initials; and
- e) Year of manufacture.

8.1.1 BIS Certification Marking

The felts may also be marked with the Standard Mark.

8.1.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made there under. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 PACKING

9.1 Before packing, the unproofed felt shall be sprinkled uniformly with finely powered naphthalene or other suitable insecticide at the rate of 1 kg/m³ in case the felt is intended for internal market, and 5 kg/m³ in case the felt is intended for export market.

9.2 Felts of bigger sizes (for example, of 14 m length) shall be rolled individually. In case of felts of smaller sizes (for example, of 4 m length), a suitable number of pieces depending upon thickness and the mass shall be rolled together. The rolls shall be wrapped with one layer of polyethylene film (*see* IS 2508) of minimum 40 microns thickness and tied with twine at minimum two places to form compact rolls. A number of such rolls shall then be covered completely by an outer layer of heavy cee cloth (*see* IS 3751) or equivalent hessain [*see* IS 2818 (Parts 1 to 6)] to form a bale. The heavy cee cloth or hessain shall be tightly stitched with jute twine. The distance between the adjacent stitches shall not be more than 5 cm. The maximum mass of the bale shall be 40 kg or as agreed.

10 SAMPLING AND CRITERION FOR CONFORMITY

10.1 Lot

The quantity of felt of same type, grade and thickness delivered to a buyer against a despatch note shall constitute a lot.

10.2 The conformity of a lot to the requirements of this specification shall be determined on the basis of the tests carried out on the sample selected from it.

10.3 Unless otherwise agreed to between the buyer and the seller, the number of rolls/pieces to be selected at random from a lot shall be in accordance with col 1 and 2 of Table 5.

Table 5 Sample Size and Criteria for Conformity
(Clauses 9.3 and 9.4)

Number of Rolls/Pieces in the Lot	Number of Rolls/Pieces to be Selected	Permissible Number of Non-Conforming Rolls/Pieces	Sub-Sample Size
(1)	(2)	(3)	(4)
Up to 50	5	0	2
51 " 150	8	0	2
151 " 300	13	1	3
301 " 500	20	1	3
501 and above	32	2	5

10.4 The number of test samples and the criteria for conformity of a lot for various characteristics shall be as follows:

<i>Characteristics</i>	<i>Number of Test Samples</i>	<i>Criteria for Conformity</i>
Thickness and width	According to col 2 of Table 5	Non-conforming rolls/pieces shall not exceed the corresponding number given in col 3 of Table 5
Length	According to col 2 of Table 5	None of the pieces shall be less than the declared length
Density, tensile strength, splitting resistance, oil retention, chemical requirements, colour fastness and wool content	According to col 4 of Table 5	All the test samples shall satisfy the relevant requirements

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
199 : 1989	Textiles estimation of moisture, total size or finish, ash and fatty matter in grey and finished cotton textile materials (<i>third revision</i>)	(Part 4) : 1971	213 and 270 g/m ² at 14 percent contract regain (<i>first revision</i>)
		(Part 5) : 1974	298 g/m ² at 16 percent contract regain
686 : 1985	Methods for determination of colour fastness of textile materials to daylight (<i>first revision</i>)	(Part 6) : 1977	245 g/m ² at 16 percent contract regain
766 : 1988	Methods for determination of colour fastness of textile materials to rubbing (<i>first revision</i>)	3098 : 1983	Oil, hydraulic, mineral oil type (<i>second revision</i>)
		3456 : 1966	Method for determination of water soluble matter of textile materials
767 : 1988	Methods for determination of colour fastness of textile materials to water (<i>first revision</i>)	3522	Methods for estimation of common preservatives used in textiles industry :
1390 : 1983	Methods for determination of pH value of aqueous extracts of textile materials (<i>first revision</i>)	(Part 1) : 1989	Part 1 (<i>first revision</i>)
1954 : 1990	Method for determination of length and width of fabrics (<i>second revision</i>)	(Part 2) : 1989	Part 2 (<i>first revision</i>)
		(Part 3) : 1983	Part 3
1964 : 1970	Methods for determination of weight per square metre and weight per linear metre of fabrics (<i>first revision</i>)	3751 : 1993	Textiles — Heavy cee jute cloth (<i>first revision</i>)
		4202 : 1967	Method for determination of chloride content of textile materials
2454 : 1985	Methods for determination of colour fastness of textile materials to artificial light (xenon lamp) (<i>first revision</i>)	4203 : 1967	Method for determination of sulphate content in textile materials
2508 : 1984	Low density polyethylene films (<i>second revision</i>)	5152 : 1969	Method for estimation of benzyl-methyl alcohol soluble matter in textile materials
2818	Indian hessian:		
(Part 1) : 1990	General (<i>second revision</i>)	6359 : 1971	Method for conditioning of textiles
(Part 2) : 1971	305 and 229 g/m ² at 16 percent contract regain (<i>first revision</i>)	8476 : 1977	Method for determination of wool content in woollen textile materials
(Part 3) : 1971	213 and 270 g/m ² at 16 percent contract regain (<i>first revision</i>)	11662 : 1986	Preservative treatments of textile materials

ANNEX B

(Tables 1, 2 and 3)

METHODS OF TEST

B-1 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

B-1.1 The tests shall be carried out in standard atmosphere at $27 \pm 2^\circ\text{C}$ temperature and 65 ± 2 percent relative humidity (*see also* IS 6359).

B-1.2 Prior to test, the specimens shall be conditioned to moisture equilibrium in the standard atmosphere. When the specimens have been left in such an atmosphere for 48 hours in such a way as to expose as far as possible all portions of the specimens, they shall be deemed to have reached the moisture equilibrium.

B-2 THICKNESS

B-2.1 Test Specimens

Each of the samples selected according to 10.4 shall constitute test specimens.

B-2.2 Apparatus

B-2.2.1 Micrometer Gauge

The gauge shall be provided with the following :

- a) Circular presser foot,
- b) A dial graduated in millimetres to read the thickness of the specimen,
- c) Means for adjusting the pressure to be applied on the specimen,
- d) Means for adjusting the pointer on the dial to zero position, and
- e) Means to enable measurements to be made at any distance greater than 15 cm away from the edge of the specimen.

B-2.2.2 The gauge shall meet the following requirements:

- a) The presser foot shall have an area which is nearest to the value calculated by taking the diameter of the presser foot to be 5 times the estimated or assumed thickness of the felt under test.
- b) The dial shall be capable of being read to an accuracy of at least 0.05 mm.
- c) The presser foot and the anvil (or lower foot) surfaces shall be plane within 0.002 mm and parallel to each other within 0.002 mm.
- d) The gauge shall be capable of providing a pressure up to 2 kPa on the test specimen.

B-2.3 Procedure

B-2.3.1 Clean the surfaces of the presser foot and the anvil. Adjust the gauge so that it provides a pressure

of 2 kPa on the specimen during the test. Set the gauge to read zero when the presser foot rests on the anvil.

B-2.3.2 Raise the presser foot and lay a portion of the specimen on the anvil and render it free from wrinkles and creases with no greater tension than is necessary to make it lie flat and straight. Lower the presser feet slowly avoiding jerks or impacts till a pressure of 2 kPa is applied on the felt. Read the dial immediately after the visible movement of the pointer ceases. The time interval before taking the thickness reading shall not be less than 10 after the pressure is applied.

B-2.3.3 Measure the thickness of the specimen under test at 10 different positions in the manner prescribed in B-2.3.2.

B-2.3.4 Find the average of the 10 readings and note it as the thickness.

B-3 DENSITY

B-3.1 Test Specimens

Each of the samples selected according to 10.4 shall constitute test specimens.

B-3.2 Procedure

B-3.2.1 Determine the mass (g/m^2) of felt by the method given in IS 1964.

B-3.2.2 Calculate the density of felt by the following formula:

$$\text{Density, g/cm}^3 = \frac{\text{Mass, g/m}^2}{\text{Thickness in mm} \times 10^3}$$

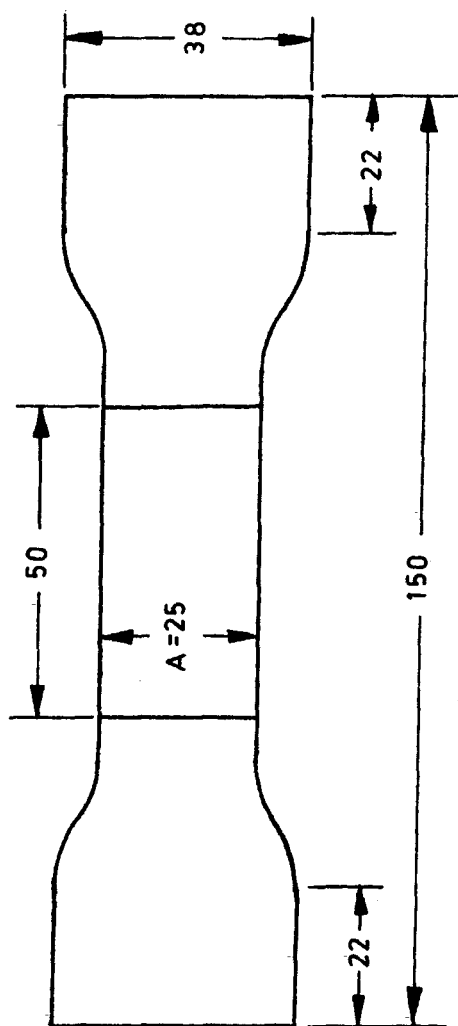
B-4 TENSILE STRENGTH

B-4.1 Preparation of Test Specimen

Cut four test specimens having the outline shown in Fig. 1 and conforming to the dimensions indicated in the figure from each of the samples selected according to 10.4 in the lengthwise and widthwise directions. Specimens shall be cut so as to cover the entire sample as far as possible.

B-4.2 Tensile Testing Machine

The machine shall be of such capacity that the maximum strength required to break the test specimen shall not exceed 85 percent nor be less than 15 percent of the rated capacity. The rate of traverse of the machine shall be 300 ± 10 mm. The distance between the two



All dimensions in millimetres.

FIG. 1 TEST SPECIMEN

grips (gauge length) shall be 75 mm. The machine shall be equipped with a type of grip which tightens automatically and exerts a uniform pressure across the gripping surfaces increasingly as the tension increases so as to prevent uneven slipping and to favour breakage of the specimen in its constricted section. It is advisable to have at the end of each grip, a positioning device so that all the specimens are inserted to the same depth in the jaws and are perpendicular to the direction of the pull. The machine shall be power-driven.

B-4.3 Procedure

Insert a test specimen into the grips of the tensile testing machine taking care to adjust it symmetrically so that the tension will be distributed uniformly over the cross-section. (If tension is greater on one side of the test specimen than on the other, reference lines will not remain parallel and the maximum strength will not be developed.) Start the machine and note the strength developed on the test specimen when it breaks. Repeat the test with the remaining test specimens and calculate the average breaking strength in respect of each sample.

B-4.4 Calculation

Calculate the tensile strength of felt by the following formula:

$$\text{Tensile strength, kPa} = \frac{L \times 10^3}{t \times W}$$

where

L = breaking strength in N,

t = thickness in mm, and

W = minimum width of the narrow portion (see A in Fig. 1), in mm

B-5 SPLITTING RESISTANCE

B-5.1 Preparation of Test Specimen

Cut four test specimens of 150 mm × 50 mm size from different portions of each of the sample selected according to 10.4 in the lengthwise and widthwise direction.

B-5.2 Tensile Testing Machine (see B-4.2)

B-5.3 Procedure

B-5.3.1 Split the specimen within the middle third of the thickness for a distance of approximately 50 mm from one end only. Clamp the lips in each jaw of the testing machine bringing the jaws close enough for the purpose. Start the machine and record the load as splitting resistance in newtons, necessary to pull the two sections of the specimen wholly apart.

B-5.3.2 Repeat the test with the remaining test specimens and calculate the average splitting resistance in respect of each sample.

B-6 OIL RETENTION

B-6.1 Principle

Specimens of given dimensions are suspended in mineral oil for a given time. They are then removed and after allowing to drain for a specified time, the specimens are weighed once more and the change in mass, expressed as a percentage of the original mass, is calculated.

B-6.2 Apparatus and Reagents

B-6.2.1 Apparatus

B-6.2.1.1 Glass cylinders with capacity and dimensions appropriate to the thickness of the test specimen.

B-6.2.1.2 Balance accurate to 1 mg.

B-6.2.1.3 Suitable equipment capable of maintaining the reagent at $27 \pm 2^\circ\text{C}$.

B-6.2.2 Reagent

Mineral oil of Grade VG 46 (*see* IS 3098).

B-6.3 Procedure

Cut four specimens of 150 mm × 25 mm size from a sample of felt, prepare and condition them in accordance with **B-1**. Determine their mass to the nearest 0.01 g (m_1). Suspend each of the specimens in a separate glass cylinder which contains approximately 100 cc of mineral oil so that they are totally immersed with the upper edge 25 mm below the oil surface. After 6 h, raise the specimens out of the liquid, allow them to drain for 1 h, and determine their mass to the nearest 0.01 g (m_2).

B-6.4 Calculation

Calculate the oil retention, expressed as a mean percentage, as given below:

$$\text{Oil retention, percent} = \frac{(m_2 - m_1) \times 100}{m_1}$$

where

m_1 = sum of total conditioned mass of all the specimens, in grams; and

m_2 = sum of the total mass of all specimens after draining, in grams.

B-7 NON-WOOL CONTENTS**B-7.1 Test Specimens**

B-7.1.1 Draw one test specimen weighing approximately 15 g from each of the test samples selected according to **7.4**. The test specimen shall consist of small swatches cut right through the thickness from different parts of the samples leaving approximately 15 cm from the edges.

B-7.2 Apparatus**B-7.2.1 Gooch Crucible**

With sintered filter plate (porosity 150 to 250 microns).

B-7.3 Reagents**B-7.3.1 Caustic Soda Solution**

5 percent.

B-7.3.2 Acetic Acid Solution

0.5 percent.

B-7.4 Procedure

B-7.4.1 Cut one test specimen into small bits. Dry them to constant mass at $105 \pm 3^\circ\text{C}$ and note the oven-dry mass. Boil the bits in caustic soda solution for 20 min. Filter through the previously weighed Gooch crucible.

B-7.4.2 Wash the residue with hot water until free from alkali. Sour with acetic acid solution and finally wash three times with water. Dry the contents by suction.

B-7.4.3 Dry the Gooch crucible with contents to constant mass at $105 \pm 3^\circ\text{C}$ and note the mass of the residue.

B-7.4.4 Calculate the non-wool content present in the test specimen by the following formula:

$$\text{Non-wool content, percent} = \frac{100 \times b}{a}$$

where

b = mass in grams of the residue (*see* **B-7.4.3**), and

a = oven-dry mass in grams of the test specimen (*see* **B-7.4.1**)

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